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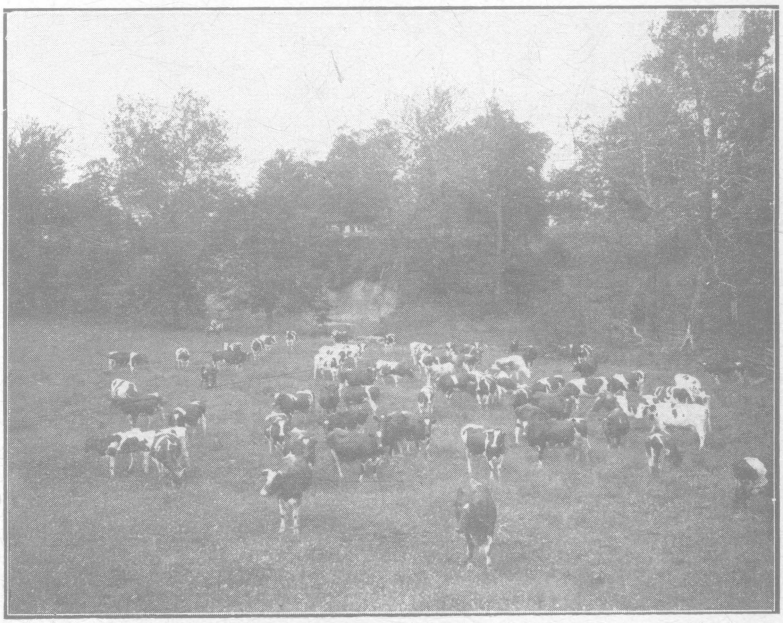
The Agricultural College

EXTENSION BULLETIN

EXPERIMENTS WITH MILK AND BUTTER
PROFESSOR JOHN W. DECKER

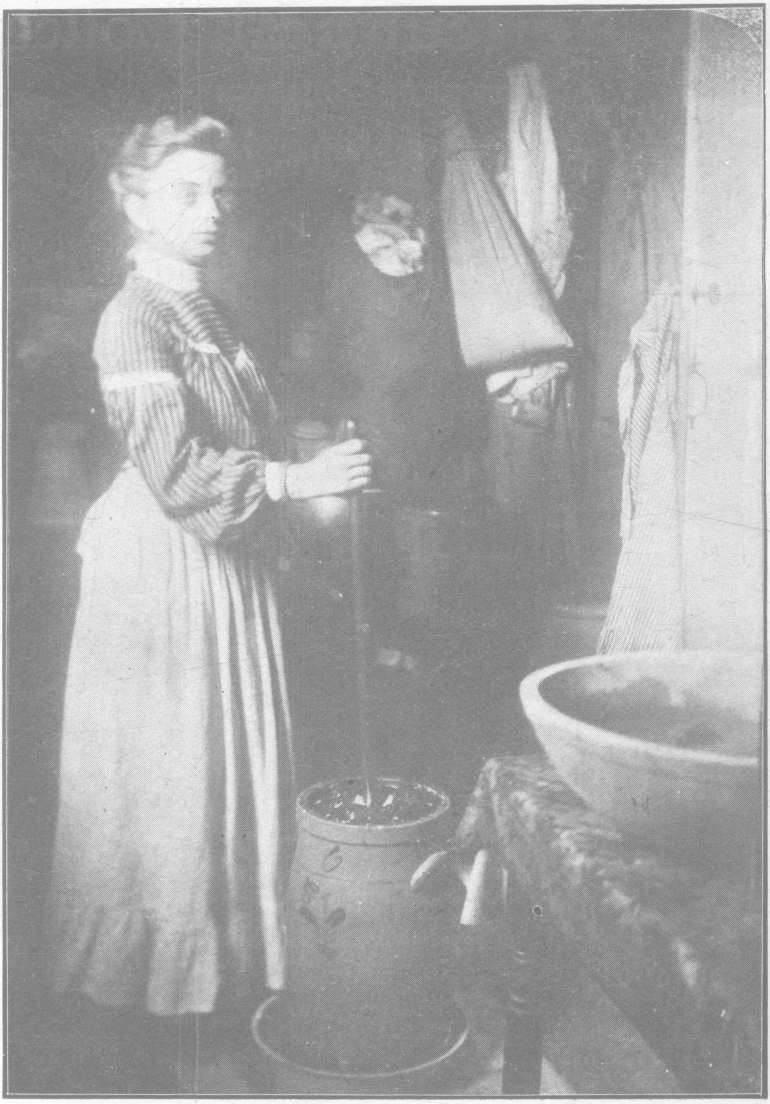
AN ELEMENTARY STUDY OF SOIL
A. B. GRAHAM



"Our sloping pasture lands are filled with herds"

PUBLISHED MONTHLY BY THE OHIO STATE UNIVERSITY

COLUMBUS



MOO-COW-MOO [1]

My pa held me up to the moo-cow-moo,
So clost I could almost touch,
En I fed him a couple of times or two,
En I wasn't a-fraid-cat much.

But ef my papa goes into the house,
En mamma she goes in, too,
I just keep still, like a little mouse,
Fer the moo-cow might moo!

The moo-cow-moo's got a tail like a rope,
En it's raveled down where it grows,
En it's just like feeling a piece of soap
All over the moo-cow's nose.

En the moo-cow-moo has lots of fun
Just swinging his tail about;
En he opens his mouth and then I run
'Cause that's where the moo comes out!

En the moo-cow-moo's got deers on his head,
En his eyes stick out of their place,
En the nose of the moo-cow-moo is spread
All over the end of his face.

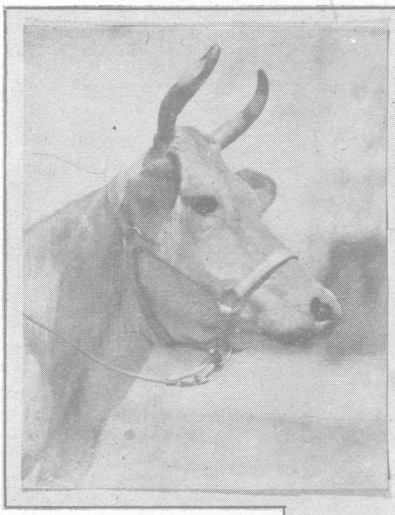
En his feet is nothing but finger nails,
En his mamma don't keep 'em cut.
En he gives folks milk in water-pails
Ef he don't keep his handles shut.

'Cause ef you er me pulls the handles,
Why, the moo-cow-moo says it hurts,
But the hired man he sits down clost by
En squirts, en squirts, en squirts!

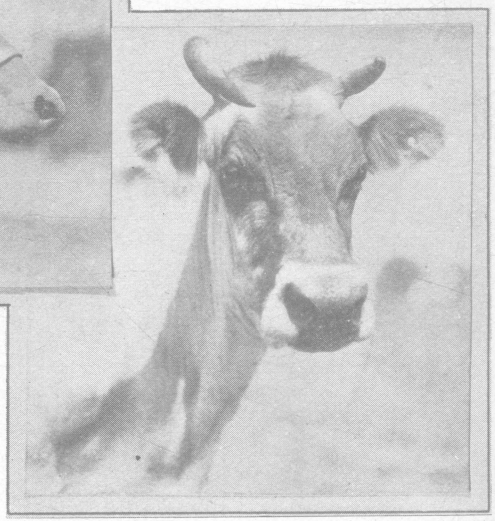
1 "Chronicles of a Little Tot," by EDMUND VANCE COOK
Published by the Dodge Publishing Company, New York. $1 25

EXPERIMENTS WITH MILK AND BUTTER

Ohio is one of the leading dairy states of the Union. Within its borders are 868,000 cows kept for milk. Their value is something more than $25,000,000. They are in all the counties, but are most numerous in the Western Reserve and in the Maumee and Miami river valleys. They produce 87,000,000 pounds of butter annually. We rank third in our production of cheese, milk, and cream. These products form an important food supply for our cities. The children on the farm ought to be interested in dairying. It is the object of this bulletin to suggest some simple but very interesting experiments that may be performed in the country school.



Milk is a substance given by a class of animals known as mammals for the nourishment of their young. Cow's milk contains all the materials necessary for the nourishment of the calf. What are these substances? Let us see.



We will do our part, if you will do yours.

Experiment No. 1

Take a tin can (a very clean baking powder can), fill it half full of milk and set it on the stove. It boils and gives off steam. The

steam is the water of the milk. A calf's body is mostly water. If we leave the can on the stove until the milk begins to brown, the water will have been given off. About seven-eighths of the milk is water and one-eighth is solid matter.

Experiment No. 2

Take a baking powder can cover; fill it half full of milk; set it on the stove and evaporate the water as in Experiment No. 1. When dry place it on the coals in the stove or on a gasoline stove. The dry matter burns. It is, therefore, organic matter. Get the

Apparatus necessary to make a simple analysis of milk

cover white hot if possible. The organic matter goes up in smoke, but there is a white ash left behind. This is the milk ash or mineral matter necessary for the bones of the calf.

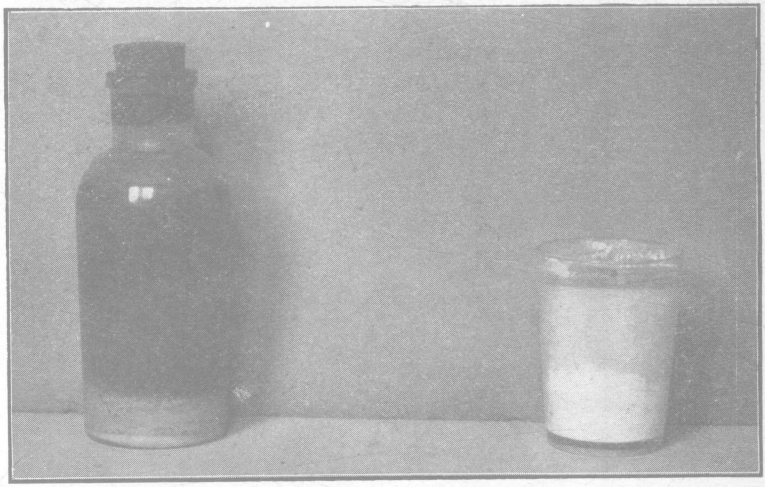
Experiment No. 3

Take about a quart of milk (preferably skimmed milk) in a tin dipper or pail. Warm it to 95 degrees F., using any common thermometer to test the temperature. Now add strong vinegar or rennet (if muriatic or sulfuric acids are to be had, they may be used, only a few drops being necessary. By addressing A. B. Graham, Agricultural College, Columbus, Ohio, enough rennet for several experiments will be mailed free of charge. Rennet is the best agent). The milk becomes thick. Stir it with a table knife or spoon until the curd or thick part is broken into pieces the size of grains of corn. Heat it to 120 degrees F. A greenish liquid appears. This liquid is called whey. The curd is the cheese part, there is about 27 pounds in 100 pounds of milk. It can be dried.

Pour off the whey into a glass fruit jar. Can you see through it plain enough to see coarse newspaper print?

Experiment No. 4

Take the whey obtained in Experiment No. 3 and heat it in a tin dipper to boiling point. If the experiment in No. 3 was performed with rennet, add a tablespoon full of vinegar. Now turn out into the glass fruit jar. Notice the little white flakes floating in the liquid. They are flakes of albumen. They have been cooked by the heating just as the white of an egg changes from transparency to white by boiling or frying. Now set the jar away for several hours. The albumen settles to the bottom. There is about seven-tenths of a pound in 100 pounds of milk. Now can you see coarse print through the liquid?



One pound of well worked butter
Dark portion, butter fat
Gray, water
Light, curd and salt
Experiment No. 8

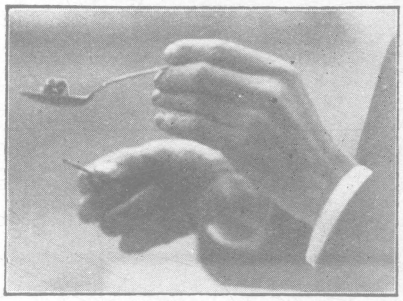
Glass of skimmed milk
Gray portion, whey
Light, curd
Experiment No. 3

Experiment No. 5

Pour off the clear liquid from the jar into the tin dipper, being careful not to stir up the albumen in the bottom. Set it on the stove and boil to dryness, being careful not to burn it. It may be necessary to stir it toward the last with a knife. The white substance is the milk sugar with part of the ash of the milk mixed with it. There are about five pounds of milk sugar in 100 pounds of milk.

Experiment No. 6

Take a bottle of soapy water. Shake it up. The air bubbles rise to the top. Notice that the bubbles are not all of the same size and that the large ones rise faster than the small ones. They form a layer of suds or cream on top. Why do the bubbles rise? The air is lighter than the surrounding liquid. Why do the large bubbles rise faster than the small ones? The liquid sticks to their



"Take a lump of butter or oleo the size of a hickory nut and enough match to melt it"

This piece froths but does not crack and sputter. Is it pure butter or oleo?

surface and retards them. The large ones have more volume than the small ones in proportion to their surfaces and consequently the retarding action is less in proportion to the lifting force.

The fat of milk is in the milk in the form of little globules, which vary in size. The casein, albumen, milk sugar, ash, and water may be likened to the soap solution and the fat globules to the air bubbles. They rise to the top, the large ones faster than the small ones, and make a layer on top which is called cream.

Experiment No. 7

Take a pint of cream, 70 degrees F., in a quart glass fruit jar. Shake it (churn it) until the butter comes. Skim out the butter, rinse it with clear water and then work into a lump. Put it in a bottle and put the bottle into a dipper of hot water. It melts down into fat or oil. It is the fat of the milk. The butter milk is just like the skim milk in composition.

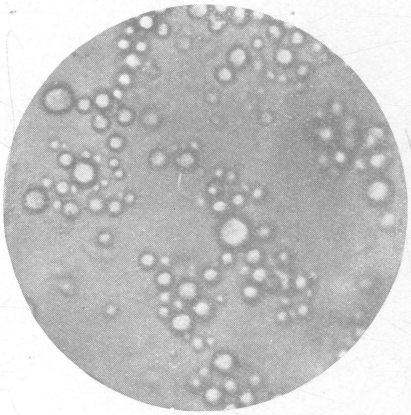
Review.

The ash goes to make bone. The casein and albumen go to make muscle, or lean meat, tendons, hoofs, horns and hair. The sugar and fat supply fat and make heat in the body of the calf.

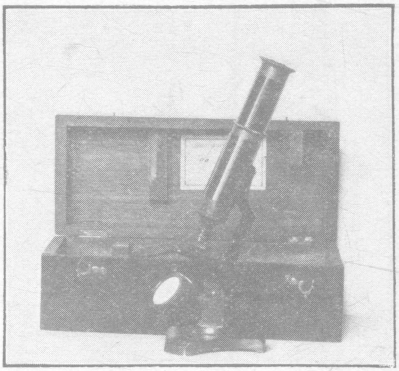
Experiment No. 8

Take a pound of butter, cut it up and put it in a tall wide-mouthed bottle. Now set the bottle in a basin of hot water until the butter is thoroughly melted. Set it in a warm place, cover on, for an hour.

It separates into layers. The top layer is oily and constitutes the greater part. Measure it and estimate the relative proportions. Butter contains about 82 to 85 per cent by weight of fat. The milky liquid is brine. If you can get it out by itself you can evaporate the water and leave the salt behind.



Fat globules as seen in cream under a microscope



This little microscope will show fat globules in cream. It can be purchased for $5.00 of Henry Kahn & Co., New York City

Notice carefully and you may see pieces of curd. It is the casein of the milk. All butter will contain some casein. It causes the butter to deteriorate. It should be washed off from the butter granules with clear water in the churn before the butter is salted and worked.

Experiment No. 9

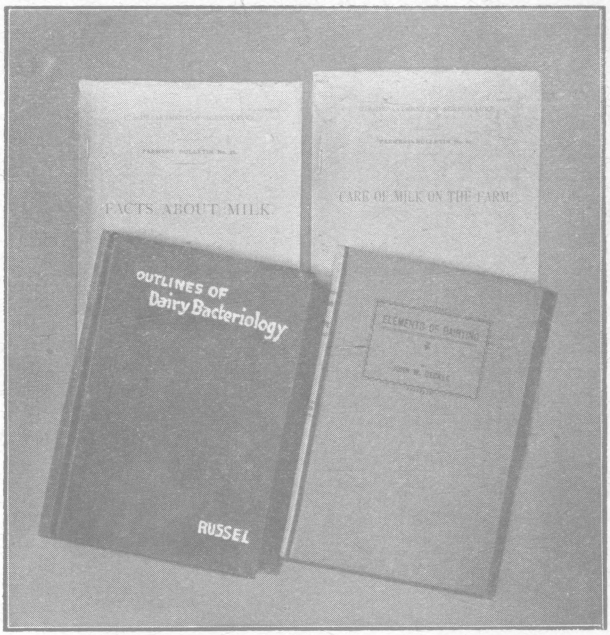
Take a small piece of butter in a teaspoon. Heat it with a lighted match. It froths freely but quietly. Try the same experiment with a piece of oleo, if it is available. It does not froth but melts down like grease and cracks and sputters. Renovated butter will do the same. Milk fat is a mixture of a number of fats, some of which are volatilized (turned into vapor) at comparatively low temperature (by the heat of the match) and makes the

butter froth. Oleo does not contain these fats. Notice the difference in the odor of the melted butter and oleo. Renovated butter is a rancid butter which has been made over by a process of heating and rechurning. The volatile fats are driven off by the heating.

Decomposition of Milk

Experiment No. 10

Take two glass fruit jars which have been thoroughly cleaned and rinsed with boiling water. Take a quantity of milk and divide equally between the two jars. Heat one to 80 degrees F. and set in a warm place. Cool the other to 50 degrees F. and set in a cool place. Note the length of time required for each to get thick. The thickening is caused by bacteria growing in the milk. They grow fastest at the higher temperature. To keep milk it should be cooled to a temperature where the bacteria do not grow fast.



Two Bulletins issued by the Agricultural Department, Washington, D. C. Two books worth having in any school library

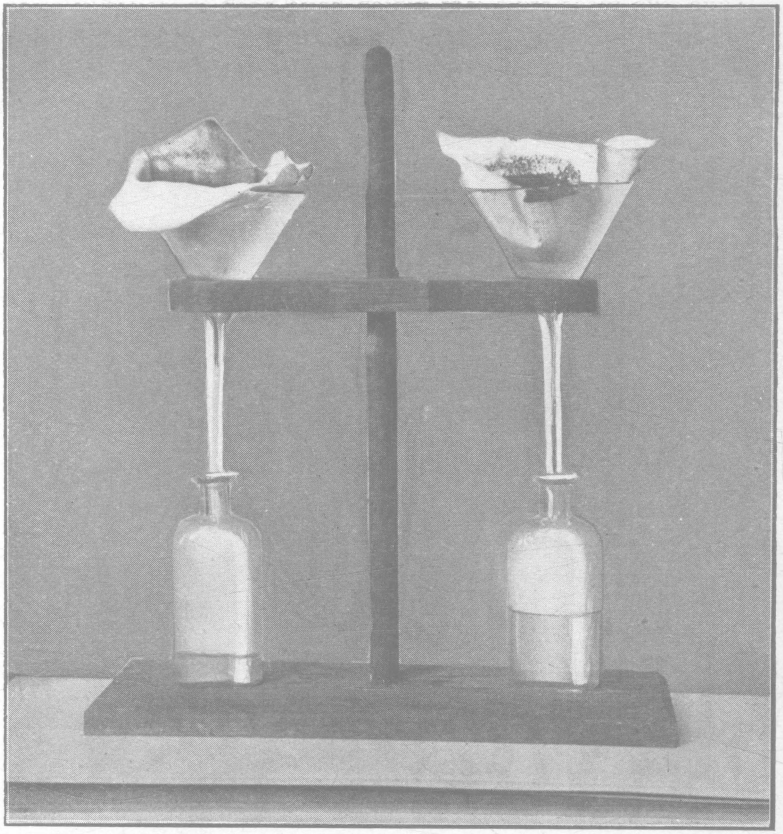
Dairy Literature

The United States Department of Agriculture publishes a series of farmers' bulletins. "Facts About Milk," No. 42, "Care of Milk on the Farm," No. 63, are two that can be had free by address-

ing Dairy Division, United States Department of Agriculture, Washington, D. C.

Two Dairy Text-Books

Elements of Dairying, by John W. Decker, Professor of Dairying, Ohio State University. Price $1.00, postpaid. Can be had by addressing the author at 325 West Eighth avenue, Columbus, Ohio.



Apparatus for Experiments 7 and 8. Ask nature your question.

Dairy Bacteriology, by Dr. H. L. Russell, Bacteriologist of the Wisconsin Experiment Station. Price $1.00, postpaid. Can be had by addressing the author at Madison, Wisconsin.

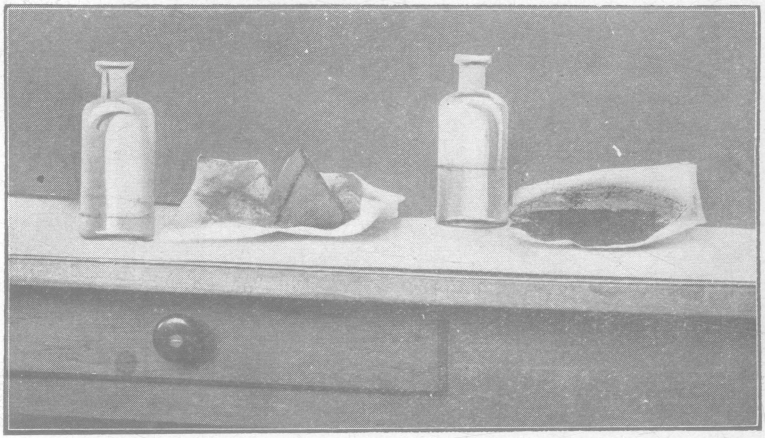
The Ohio State University offers a winter course of eleven weeks in Dairying. It is a practical course and is designed to teach young men how to make dairying pay. Write for illustrated bulletin.

A. B. GRAHAM,
Superintendent Agricultural Extension.

AN ELEMENTARY STUDY OF SOIL

Probably a knowledge of the simple facts about plants should come first, but we have chosen to make some experiments with soils, because such work can be taken up at this season better than the study of plants. In the course of our suggestions we may ask you to observe what may be silently going on as to soil formation, in your own vicinity.

If at your home or in your school you hope to learn about soils, plants, moisture, heat, and air, it will be found necessary to



Clay after water it had retained had evaporated. Very hard. Excludes air.

Black soil after water it retained had evaporated. Very loose. Permits air to enter.

put your question to nature in the form of an experiment; it will be necessary to use your eyes, also.

1. If a small handful of soil be placed on a pane of glass and rubbed backward and forward across it, a gritting noise will be heard. If the soil has been rubbed hard, it will be found that the glass has been scratched by very hard small particles which alone would not make soil. What do you think these hard particles are?

2. Place this soil or a handful of the same in a clear self-sealing fruit jar or a large clear bottle. Fill nearly full of water and shake it well. Let the soil settle and carefully draw off the water through a rubber tube or pour it off very carefully and let what remains dry near a stove. Carefully examine what is left in the can and see where most of the grit or small stones are. What composes the upper layer? Which settled the first, the coarse or fine?

3. Break a rock into small pieces. Put them into some water

in a self-sealing jar and shake them well. What do you notice in the lower part of the can? What is sand? How has it been formed?

4. Put in a glass can a little coarse gravel, sand, and soil. Add enough water to fill the can nearly full. Shake it thoroughly and let it settle. What is found in the bottom of the can? How have the layers or strata arranged themselves?

5. To show what effect the freezing of water in the crevices or small cracks in stone has, secure a granite stone about ready to

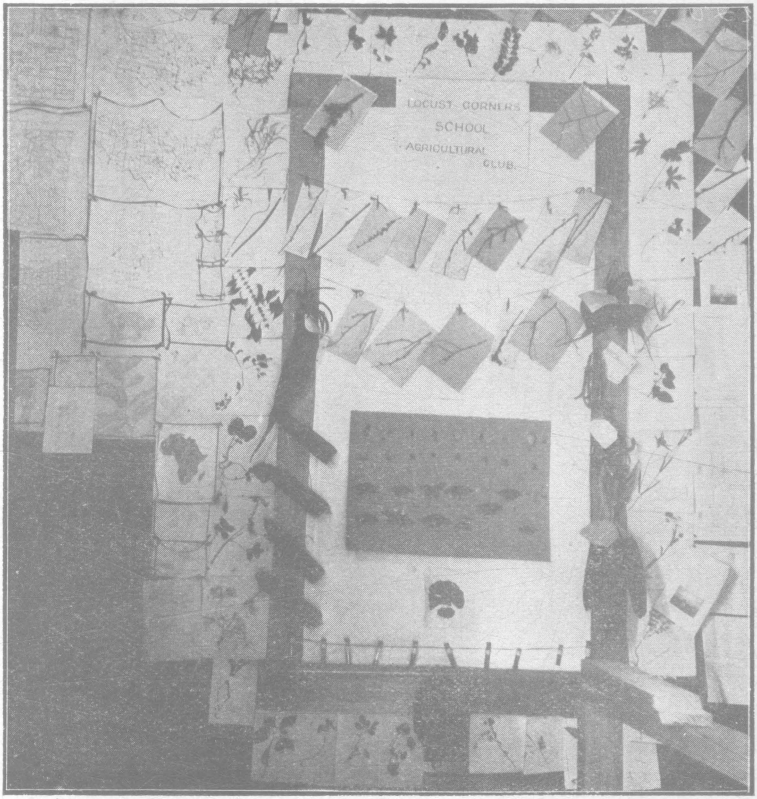
Township High School Agricultural Club at
Vaughnsville, Putnam county, Ohio.
Why should not Agriculture be a science branch in Village
and Township High Schools?

crumble. Pour some water on it during freezing weather. After the water has frozen very hard, place the stone where the air is warm enough to thaw. What result has freezing and thawing upon small rock? What effect has freezing and thawing upon ditch banks or ground plowed in the fall?

6. Freezing and thawing are not alone in effecting rocks. If a piece of iron is placed where air and water may act upon it rust soon appears. Air and water have much the same effect upon all kinds of rock. The fine particles would hardly be called "rock rust." Through hundreds of years much of this dust would become a part of the soil.

7. Place a handful of dry sand on a piece of muslin or cheese cloth in a tin funnel and pour a small bottle of water on it. Catch the water in a bottle placed beneath the funnel. Both bottles should be of the same size.

8. On another piece of cheese cloth in a tin funnel put a handful of very black soil. Pour the same quantity of water on it as

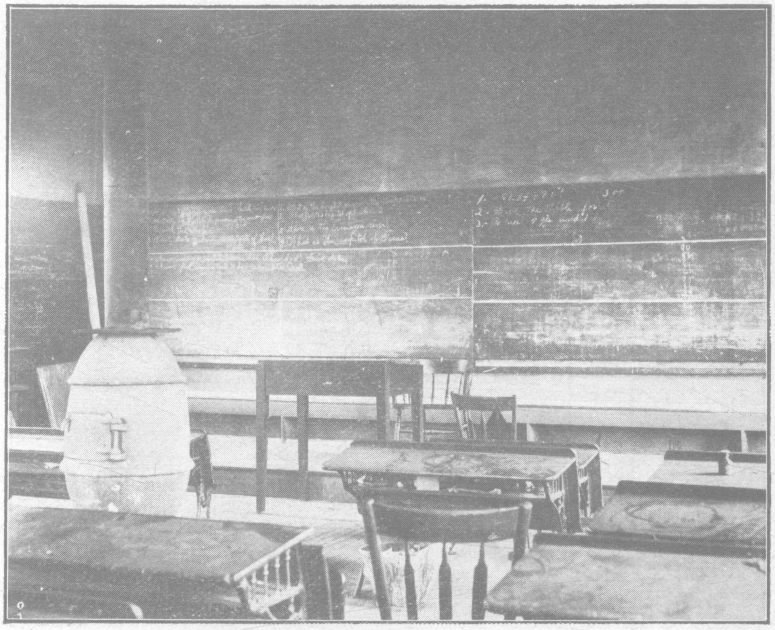


An Exhibition made at the Morrow county Fair by the Locust Corners Agricultural Club.
This work was done by an elementary school. The Fair Board awarded them $10.00 with which a library will be purchased.

was used in number 7. Catch the water in a bottle placed beneath the funnel. Which holds the more water, the black soil or the sand?

9. Try the same quantity of clay and the same quantity of water as was used in number 7. Through which did the water run most quickly? The difference between what you poured on the soil and what you caught in the bottle shows what the soil still holds. Evaporation will take that away in time.

10. Place a handful of sand on a piece of sheet iron and put it in the stove on the coals. How much of it has burned? Place a handful of the very blackest soil on the sheet iron and see how much of this soil is left unburned. That which you were not able to burn had been formed of very small particles of rock. That which could be burned was rotten plants and leaves.



Interior of An Ohio Country School

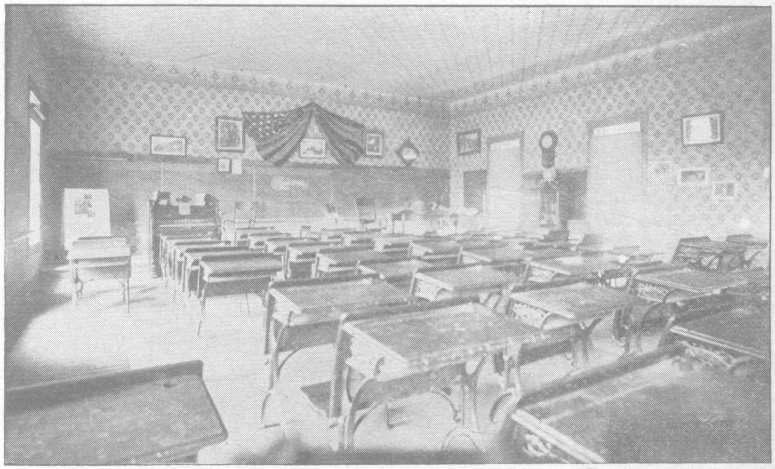
In these few simple experiments you have been assisted to learn something about those things which form the soil and in what order the finest and coarsest particles arrange themselves, as well as which soil retains the most water. You learned from the experiments outlined in the November Bulletin that a soil must not hold so much water that the air is kept out. It is hoped you are willing to carry this work further that you may learn to become more thoroughly acquainted with the soils and the plants that grow in them at and near your home.

Agricultural Club Work at County Fairs

There is no better opportunity to arouse an interest in the study of the common weed pests, insect friends and foes, the value of birds, and in the improvement of farm products, than at the county fair.

Everybody is interested in what a boy or girl can do. They should be given an opportunity to display the results of their work

not only in the subjects mentioned but in the art work of the school. Beautiful country scenes, photographs of the interiors of school rooms, of the best type of farm homes, of well-planted school grounds and home yards, well-arranged kitchens, etc., make a very interesting and suggestive exhibition.



Interior of An Ohio Country School

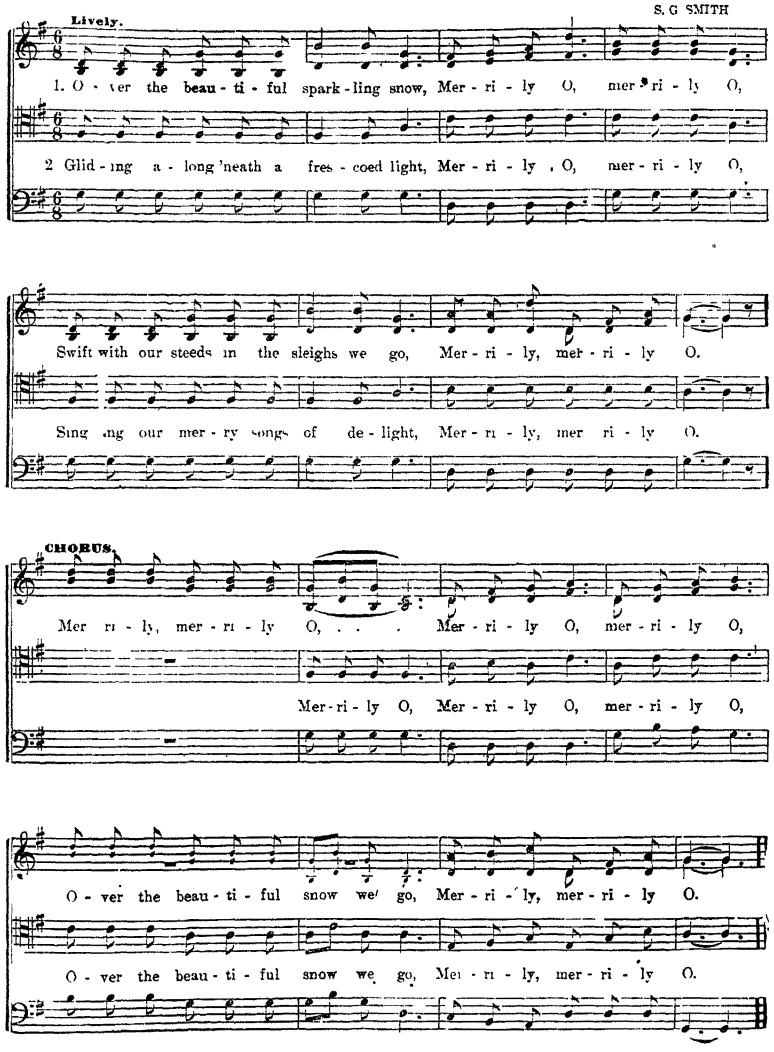
Agricultural Clubs for 1906

Teachers who are expecting to organize Agricultural Clubs should send to us early for a bulletin giving some direction as to organizing such clubs. Names of those desiring to enter the work should reach us not later than the **first of March,** 1906. Seeds, blank reports, etc., will be sent quickly and directly from the College of Agriculture this year so that those having eight-month schools will receive them in time for distribution.

A great many have not been able to make reports because seeds were not received in time. That the blank reports be filled out and returned is all that is required. Failure to send in a report for the work of 1906 will prevent any one receiving free material.

The bulletin published monthly by this department will be sent to those only who send in a report by letter or by filling in the blank reports. If blank reports for 1905 were lost, a letter telling about the work will be accepted.

Merrily O.



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